Hexagon Transportation Consultants, Inc.

Memorandum

Date: February 12, 2016

To: Ms. Shannon George, David J. Powers & Associates, Inc.

From: Gary Black & Robert Del Rio, T.E.

Subject: SCU Franklin Street Closure Traffic Study

Introduction

This memo presents the results of the traffic study for the proposed partial closure of Franklin Street at Santa Clara University in Santa Clara, California (See Figure 1). In an effort to develop and unify the campus on both sides of Franklin Street, the university has proposed to close Franklin Street from University Square to The Alameda. On Alviso Street, the street would be closed south of the new 400-space parking garage. This memo will refer to Segment 1 as the road segment on Franklin Street between Lafayette Street and Alviso Street. Segment 2 is the road segment on Franklin Street between Alviso Street and The Alameda. Segment 3 represents the road segment of Alviso Street south of Benton Street.

The analysis relies on traffic volume data that were collected in January 2014 when this traffic analysis was first initiated. The traffic study is now being completed after being placed on hold for several years. New 2016 counts were not collected at the study facilities since there has been no major development in the area that would result in a measurable change in traffic volumes on study facilities. The parking garage on Alviso and Benton Street had been completed at the time that the January 2014 counts were collected and the parcels along Franklin Street, which is the focus of this study, are part of Santa Clara University. Therefore, any development of parcels along Franklin Street that may have occurred since the collection of count data in January 2014 would not result in traffic volume changes in the area since these facilities are part of the university.

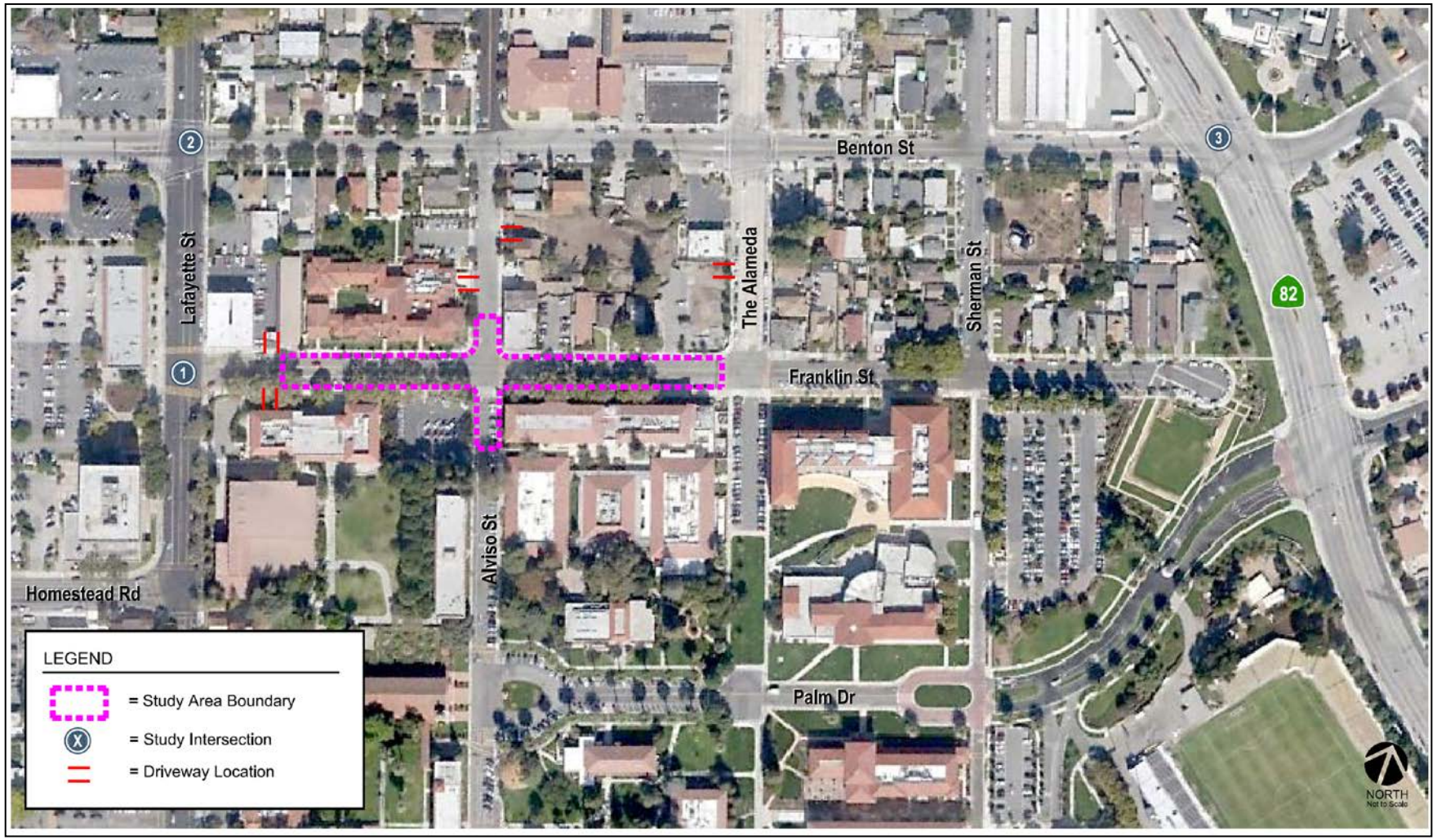
Scope of Work

The purpose of this study is to identify for Santa Clara University the amount of traffic that would be reassigned with the proposed closure and the potential traffic impacts of the closure on nearby affected intersections. Traffic was reassigned based on existing traffic patterns within the studied roadway segments and assuming the proposed closures. The potential impacts of the reassignment were then evaluated in accordance with the standards set forth by the City of Santa Clara and the Santa Clara Valley Transportation Authority (VTA) Congestion Management program (CMP). The traffic analysis is based on the AM and PM peak hour levels of service for two signalized intersections and one unsignalized intersection. The study intersections were selected based on estimates of the extent of the changes that would occur to the roadway network surrounding the project (See Figure 1), identified below:

1. Franklin Street and Lafayette Street (unsignalized),
2. Benton Street and Lafayette Street, and
3. Benton Street and El Camino Real.

Traffic conditions at the study intersections were analyzed for the weekday AM and PM peak hours of adjacent street traffic. In the study area, the AM peak hour typically occurs between 8:00 AM and 10:00 AM, while the PM peak hour typically occurs between 4:00 PM and 6:00 PM.

Figure 1
Site Location and Study Intersections



Traffic conditions were evaluated for the following scenarios:

Scenario 1: *Existing Conditions.* Existing conditions were represented by existing peak-hour traffic volumes on the existing roadway network. Existing traffic volumes were obtained from traffic counts conducted in 2014, while school was in session.

Scenario 2: *Existing plus Franklin Closure Conditions.* The effects of the street closure were evaluated using the existing traffic volumes plus traffic reassigned from the closed streets. Reassignment of the traffic was based on traffic patterns observed on Segments 1, 2, and 3 during four busy hours on a Tuesday and Wednesday.

City of Santa Clara Signalized Intersection LOS Standards and Methodologies

Traffic conditions at the study intersections were evaluated using level of service (LOS). *Level of Service* is a qualitative description of operation conditions ranging from LOS A, or free-flow conditions with little or no delay, to LOS F, or jammed conditions with excessive delays. The signalized study intersections are subject to the City of Santa Clara level of service standards. The City of Santa Clara level of service methodology is TRAFFIX, a traffic analysis software system that is based on the Highway Capacity Manual (HCM) method for signalized intersections. TRAFFIX evaluates signalized intersections operations on the basis of average delay time for all vehicles at the intersection. The City of Santa Clara level of service standard is LOS D or better. The City of Santa Clara does not have an adopted level of service standard for unsignalized intersections.

Existing Conditions

Existing Lane Configurations and Volumes

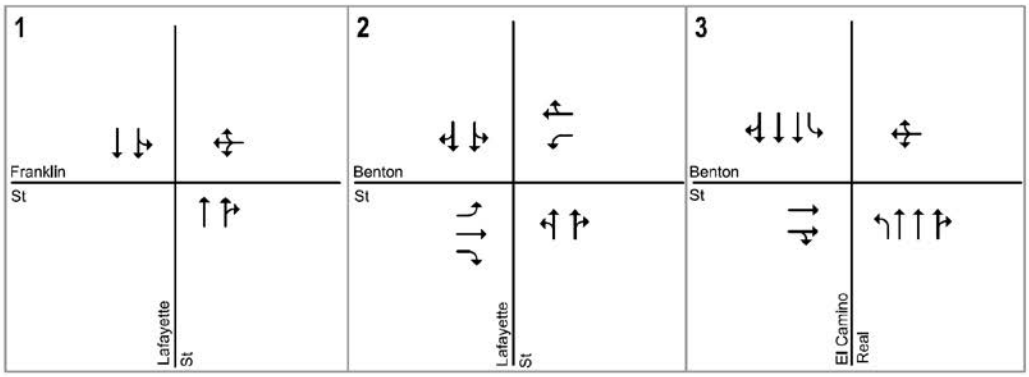
The existing lane configurations of the study intersections were obtained from field observations (see Figure 2). The existing traffic volumes were obtained from turning movements counts completed while school was in session in January 2014. A comparison of the January 2014 count data utilized in this analysis with recent available count data was completed to ensure that there has been no significant change in traffic volumes in the project study area that would invalidate the use of the 2014 count data. The primary roadways in the project study area include Benton Street, Lafayette Street, and El Camino Real. Therefore, available count data at two intersections (Benton Street/Lafayette Street & Benton Street/El Camino Real) that were collected in October 2014 and April 2015 were reviewed.

The comparison of the count data indicates no more than a 7% increase in total traffic volumes at the subject intersections when comparing recent data to the counts collected in January 2014. Similarly, when comparing traffic volumes on the segment of Benton Street that runs parallel to Franklin Street, which is the focus of this study, there has been minimal change in traffic volumes. The count comparison indicates that AM peak hour volumes have increased by an average of only 11% along the segment while average PM peak hour volumes on the same segment have actually decreased. The count data comparisons are summarized in Tables 1 and 2 below.

The comparison of the January 2014 count data with recent count data does not indicate significant changes in traffic volumes given that it is not uncommon to find variations in traffic data of approximately 10% on a daily basis through intersections. Therefore, the use of traffic data collected in January 2014 is reflective of current traffic conditions within the project area and study facilities. The existing traffic volumes at the study intersections are shown on Figure 3.

Figure 2

Existing Lane Configurations



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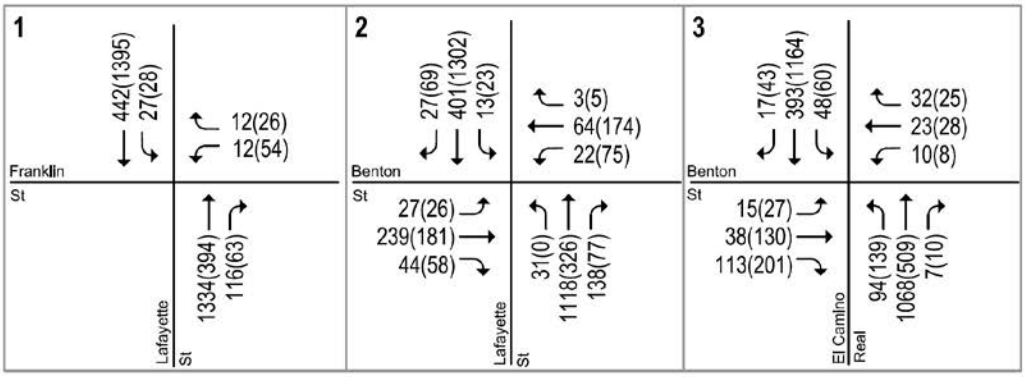
X = Study Intersection

Figure 3
Existing Traffic Volumes



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= Study Intersection

XX(XX) = AM(PM) Peak-Hour Volumes

Table 1
Intersection Count Data Comparison

Intersection	Peak Hour	Jan. 2014 Data[1] Count Date	Jan. 2014 Data[1] Total Volume	Oct. 2014 Data Count Date	Oct. 2014 Data Total Volume	Oct. 2014 Data Volume Change	Oct. 2014 Data % Change	Apr. 2015 Data Count Date	Apr. 2015 Data Total Volume	Apr. 2015 Data Volume Change	Apr. 2015 Data % Change
Lafayette Street and Benton Street	AM	01/28/14	2,127	10/08/14	2,159	32	2%	04/22/15	2,169	42	2%
	PM	01/28/14	2,316	10/08/14	2,485	169	7%	04/22/15	2,423	107	5%
El Camino Real and Benton Street	AM	01/28/14	1,858	10/08/14	2,024	166	9%	04/22/15	2,056	198	11%
	PM	01/28/14	2,244	10/08/14	2,385	141	6%	04/22/15	2,473	229	10%
					AM Average		5%		*AM Average*		6%
					PM Average		7%		*PM Average*		7%
					Overall Average		**6%**		**Overall Average**		**7%**

Note:
[1] Count data collected January 28, 2014 and utilized in analysis.

Table 2
Benton Street Count Data Comparison

Intersection	Direction	Jan. 2014 Data[1] Volume AM	Jan. 2014 Data[1] Volume PM	Oct. 2014 Data Volume AM	Oct. 2014 Data Volume PM	Oct. 2014 Data % Change AM	Oct. 2014 Data % Change PM	Apr. 2015 Data Volume AM	Apr. 2015 Data Volume PM	Apr. 2015 Data % Change AM	Apr. 2015 Data % Change PM
Benton Street at Lafayette Street	WB	89	254	85	216	-4%	-15%	93	238	4%	-6%
	EB	390	281	460	292	18%	4%	438	361	12%	28%
Benton Street at El Camino Real	WB	134	210	130	207	-3%	-1%	143	199	7%	-5%
	EB	166	358	187	256	13%	-28%	201	265	21%	-26%
				WB Average		*-4%*	*-8%*	*WB Average*		*6%*	*-6%*
				EB Average		*15%*	*-12%*	*EB Average*		*17%*	*1%*
				Overall Average		**6%**	**-10%**	**Overall Average**		**11%**	**-2%**

Note:
[1] Count data collected January 28, 2014 and utilized in analysis.

Existing Transit Facilities

There is one VTA transit line (#32) operating on the part of Franklin Street that would be closed. Bus #32 connects west to Los Altos and Palo Alto, and east to the Santa Clara Transit Center just east of Santa Clara University. Within the study area, the eastbound bus enters Franklin Street from northbound Lafayette Street, stops in front of the Music & Dance building, and then exits the study area by turning left onto The Alameda. The westbound bus from the Santa Clara Transit Center does not use Franklin Street. It travels on Benton Street straight to Lafayette Street. The proposed street closure would require the rerouting of the eastbound bus line and the relocation of the bus stop on Franklin Street.

Existing Parking Facilities

The proposed Franklin Closure would affect two major parking facilities. One B-permit (Faculty/Staff) parking facility on Alviso and Franklin with 21 spaces would be closed under the proposal. The larger B&E-permit (Faculty/Staff & Non-resident Students) new parking garage on Alviso and Benton would be affected to the extent that all traffic would need to use Benton, whereas some traffic now uses Franklin. The garage would receive additional demand from the displaced on-street parking and the 21-space parking facility. All other parking facilities would not be affected by the closure.

Observed Existing Traffic Counts

Hexagon Transportation Consultants, Inc. conducted traffic counts for one full week in January 2014 on the studied road segments (see Table 3). However, the tube counts on Segment 1 are incomplete because the tubes were vandalized at 5 AM on Wednesday (Jan 29th, 2014). The counts on Segment 2 and 3 were used to estimate volumes on the missed days. Traffic volumes during the weekdays were much higher than the weekend. Wednesday had the highest volumes. Counts for Segment 2 ranged from 700 to 800 on the weekend and from 1,220 to 1,832 on the weekdays with Wednesday receiving the highest volume of 1,832. Counts for Segment 3 ranged from 300 to 400 on the weekend and from 400 to 810 on the weekdays with Wednesday receiving the highest volume of 810. This report thus used Wednesday volumes as the daily volume to account for the highest daily volume on these segments. Since Segment 1 counts were tampered with, Wednesday counts for this segment were extrapolated from observed volume patterns between Segment 1 and Segment 2. This study estimated the daily volume for Segment 1 at 2,275 trips per day.

Table 3

Observed Existing Traffic Counts

Roadway	Location	Sunday 1/26/2014	Monday 01/27/14	Tuesday 01/28/14	Wednesday 01/29/14	Thursday 01/30/14	Friday 01/31/14	Saturday 02/01/14
Franklin St	between Lafayette St and Alviso St	1269	1740	1701	2275 /a/	0 /a/	0 /a/	0 /a/
Franklin St	between Alviso St and The Alameda	715	1515	1274	1832	1564	1249	740
Alviso St	between Franklin St and Benton St	373	437	643	810	427	609	373
Note: /a/ Tubes were vandlized at 5AM on Wednesday.Wednesday volume is estimated based on other segments								

Observed Existing Traffic Patterns

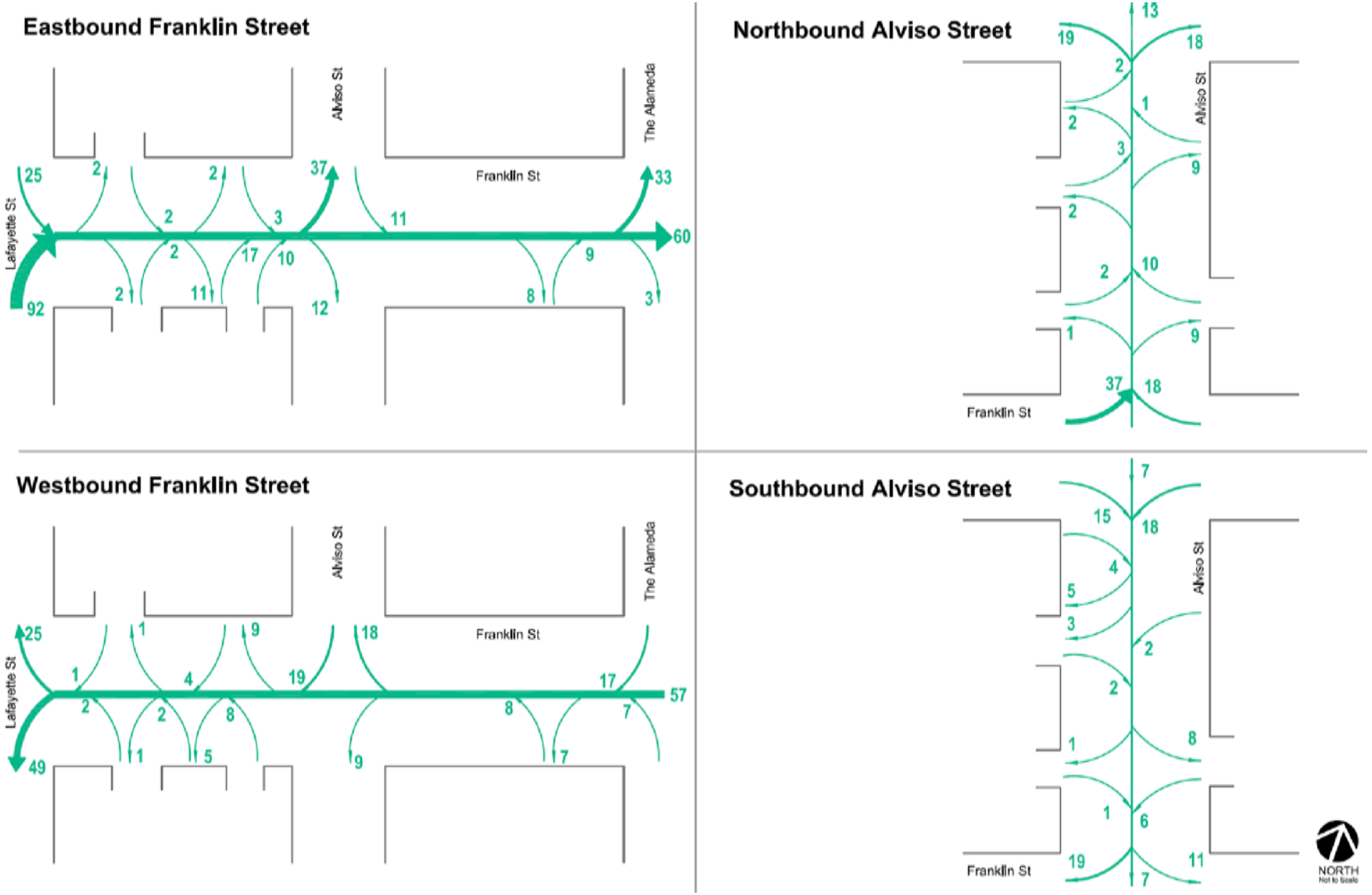
Traffic patterns were observed on the three road segments in order to identify the existing origins and destinations of traffic and to provide the basis for reassigning trips to alternate routes through the study area (see Figure 4). This survey was conducted on two typical weekdays each for two busy hours (Tuesday 1:00 PM – 3:00 PM and Wednesday 9:30 AM – 11:30 AM).

On Segment 1 (Franklin between Lafayette and Alviso), an average of 122 trips per hour was observed. Around 80% of the eastbound traffic turned in from northbound Lafayette and most (~80%) of the eastbound traffic then continued straight on Franklin to Segment 2. Since on-street parking was consistently full, the through traffic most likely proceeded to the next block searching for parking. Around 70% of the westbound traffic originated from Segment 2 and most (~80%) of all westbound traffic then turned left onto southbound Lafayette. Because of heavy through traffic on Lafayette and pedestrian crossing volume, left-turns from Franklin Street had few gap intervals. Queues of five or more cars occasionally formed on westbound Franklin Street, but traffic on Franklin was low enough that the queues appeared only temporarily. Most of the other origin-destination pairs were from the on-street parking to Alviso Street. The driveways to the parking lot south of Franklin Street on Alviso Street also generated some traffic. The driveways to the Music & Dance building and the University Square buildings generated little traffic during the observation hours.

On Segment 2 (Franklin between Alviso and The Alameda), an average of 92 trips per hour was observed. Around 90% of the eastbound traffic was fed by eastbound through traffic on Segment 1. On-street parking was not consistently full so some (~10%) eastbound trips ended within the block; around 50% of all eastbound traffic continued to the surface parking lots on Sherman Street within the campus, and all other eastbound traffic turned onto The Alameda for parking. Around 80% of the westbound traffic was from through traffic on Franklin. Most (~80%) of all westbound traffic then continued straight through the segment. Trips to-and-from both The Alameda and Alviso Street constituted only a fraction of all trips. Trips originating from the on-street parking within the block were evenly split between continuing westbound on Franklin or turning onto The Alameda.

On Segment 3 (Alviso between Franklin and Benton), an average of 67 trips per hour was observed. Around 50% of all observed trips travelled through the block. Their origins and destinations were evenly split between the six approaches on both ends of the street. These trips most likely are circling around the blocks looking for parking spots. The 400-space parking garage and the Jesuit community parking lot generated around 40% of all trips. The other 10% of all trips were generated by the on-street parking. This street received relatively low traffic compared to Segment 1 and 2. While the 400-space parking garage on this segment is the largest

Figure 4
Existing Traffic Patterns



parking structure that accommodates B&E permits, its distance to the entire campus in comparison to the parking lots on Sherman could have contributed to its low trip counts.

Level of Service Analysis under Existing Conditions

The studied intersections were evaluated for level of service under existing conditions. These LOS results are used as the basis for evaluating the traffic impacts of the proposed street closure. The results of this analysis are shown in Table 4.

Other than the Franklin & Lafayette unsignalized intersection, the other two intersections are operating at acceptable levels of service during the AM and PM peak hours based upon City of Santa Clara level of service criteria. Since Lafayette Street carries a very high amount of through traffic, gap times for left-turn movements were short. Furthermore, crossing pedestrian volume also slowed the through traffic. As a result, although left-turn traffic was low in volume, the resulting lengthy vehicle delays cause the left turn to be rated at a LOS E.

Table 4

Existing Level of Service Results

Study Number	Intersection		Existing	
		Peak Hour	Avg Delay	LOS
1	Lafayette Street and Franklin Street /a/	AM	35.9	E
		PM	26.9	D
2	Lafayette Street and Benton Street	AM	16.3	B
		PM	17.3	B
3	El Camino Real and Benton Street	AM	15.9	B
		PM	20.5	C

Note:
/a/ LOS for unsignalized intersection represents the worst case scenario

Street Closure Traffic Analysis

This section will first describe the study methodology, and then conclude by reporting and analyzing the traffic volume change to Benton Street and level of service (LOS) results for Scenario 2.

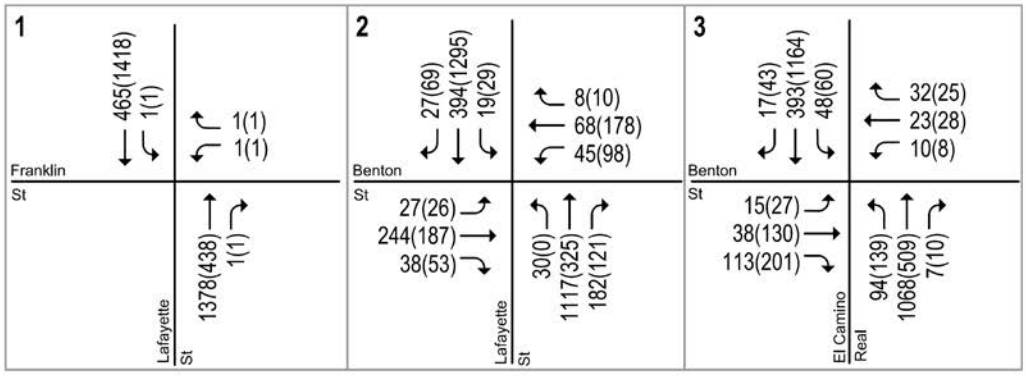
Methodology for Street Closure and Traffic Volume Reassignment

On Franklin Street, the street would be closed from University Square to The Alameda. On Alviso Street, the street would be closed south of the Jesuit community underground parking driveway. Lane configurations at the study intersections would be unchanged.

With the proposed closure, around 2,200 trips per day on Franklin Street would require reassignment. This study reassigned traffic in accordance with the observed traffic patterns. For trips generated by parking lots and on-street parking spaces that would be displaced with the proposed street closure, they were all rerouted to use the 400-space parking garage. For all other trips that have neither their origins nor destinations removed, they were all rerouted to use Benton Street. For the studied Lafayette & Franklin intersection, all trips to-and-from Franklin Street (except to-and-from the two unclosed driveways) were eliminated because of the closure. The traffic volumes assuming the street closure are shown on Figure 5. As expected, traffic volumes at Lafayette & Franklin would decrease while volumes would increase at Lafayette & Benton. Since no streets adjacent to the El Camino & Benton intersection would be closed, this intersection would have no change in traffic.

Figure 5

Traffic Volumes Under Street Closure



LEGEND

X = Study Intersection

XX(XX) = AM(PM) Peak-Hour Volumes

Existing plus Franklin Closure Conditions

Volume Changes on Benton Street

From the intersection peak hour volumes, this study extrapolated the existing daily volumes on Benton Street between Lafayette Street and Alviso Street at an estimated 7,250 trips per day. Using the same methodology, the additional daily volume reassigned to Benton assuming the Franklin closure was extrapolated at 2,200 trips per day. The total daily volume on Benton Street between Lafayette and Alviso assuming the Franklin closure was thus estimated at 9,500 trips per day, a 30% increase from the existing traffic volume. However, tube counts have shown that university-related traffic is spread out between 8:30 to 11:00 in the morning and 2:00 to 6:00 in the evening. These peak hour ranges coincided only partially with the peak hour ranges for the intersections. As a result, this study does not expect the additional reassigned traffic to impact the operations on Benton Street significantly.

Level of Service Results

The study intersections were evaluated for level of service under the conditions of the street closure with traffic volumes redirected from the closed streets (see Table 5). As expected, the proposed Franklin Street closure project would not significantly change operations at the study intersections. On Lafayette & Benton and El Camino & Benton, the LOS would remain unchanged for both the AM and PM peak hours, and the increase in average delay would be minimal. At the Lafayette & Franklin intersection, the street closure would eliminate most of the existing left-turn movements, so the left turn LOS would improve in both the AM and PM peak hours.

Table 5

Existing plus Closure Condition Level of Service Results

Study Number	Intersection		Existing		Existing + Closure	
		Peak Hour	Avg Delay	LOS	Avg Delay	LOS
1	Lafayette Street and Franklin Street /a/	AM	35.9	E	28.5	D
		PM	26.9	D	16.6	C
2	Lafayette Street and Benton Street	AM	16.3	B	16.8	B
		PM	17.3	B	18.2	B
3	El Camino Real and Benton Street	AM	15.9	B	15.9	B
		PM	20.5	C	20.5	C

Note:
/a/ LOS for unsignalized intersection represents the worst case scenario

Conclusions

This memo presents the results of the traffic study for the proposed Franklin Street closure project. The key findings are summarized below:

- The Franklin Street closure project would not impact the three studied intersections on Lafayette Street and Benton Street. The project would improve the level of service at the unsignalized intersection of Lafayette & Franklin by removing most of the left-turn volume.
- The eastbound VTA bus line #32 would require rerouting from Franklin Street to Benton Street. The bus stop in front of the Music & Dance building along Franklin Street would also require relocation.
- Driveways to the Music & Dance building, University Square, the Jesuit Community underground parking lot, and the newly constructed 400-space parking garage would be unaffected by the street closure. The 21-space parking lot (Permit B) on the south end of Alviso Street would be displaced along with all on-street parking on the affected roadway segments.